

COVER PAPER

Improving Physical Properties of Polypropylene Nanocomposites by a Natural Resource-Based Bottom-up Graphene Oxide Filler

Huiseob Shin, Min-Young Lim, Saerom Kong, Sangwan Kim, Seung Won Lee, Yonghoon Lee, and Jong-Chan Lee*

Vol. 29, No. 7, pp 487–493 (2021) | JUL 25, 2021 | DOI 10.1007/s13233-021-9062-z



Cover image depicts the preparation of carbon nanomaterials using natural derivatives. Citric acid and tannic acid were carbonized to produce bottom-up graphene oxide (BGO), and BGO was functionalized with cardanol to produce cardanol-BGO (CBGO) which can be used as a filler to increase the mechanical strength of polypropylene.

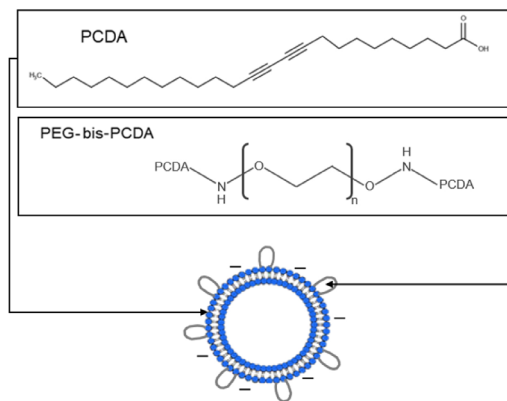
COMMUNICATION

Modifying Polydiacetylene Vesicle Compositions to Reduce Non-Specific Interactions

Gumaro Rojas,
Priyanka Shiveshwarkar,
Butaek Lim, Anura Shrestha,
Izele Abure, Anthony Nelson,
and Justyn Jaworski*

Macromol. Res., **29**, 449 (2021)

By tuning the intra-vesicular composition with respect to the ratio of 10, 12 pentacosadiynoic acid (PCDA) amphiphiles and poly(ethylene glycol) (PEG)-bis-PCDA of varying PEG lengths, stable suspensions of fluorescent vesicles were prepared that exhibited dramatically reduced non-specific interactions with cultured cells.



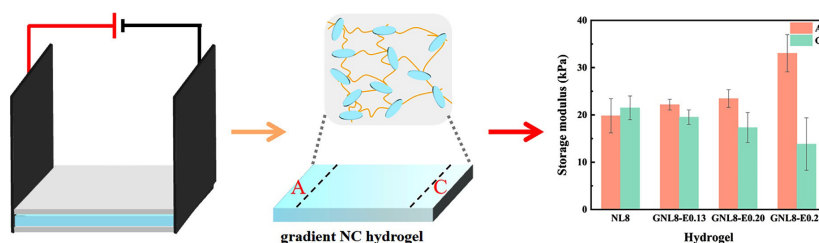
ARTICLES

Fabrication of Stiffness Gradient Nanocomposite Hydrogels for Mimicking Cell Microenvironment

Yan Hu, Yang Yang, Fei Tian,
Pingping Xu, Rongcheng Du,
Xuehuan Xia, and Shimei Xu*

Macromol. Res., **29**, 453 (2021)

It has attracted much attention to develop a gradient hydrogel for real mimic of the extracellular matrix. Despite simplicity and ease of electrophoresis preparation method, some drawbacks limit the application of the method including toxic organic crosslinker residual, specific ionic monomer types, as well as narrow gradient gaps. In this work, we successfully prepared gradiently crosslinked nonionic PNIPAm/Laponite nanocomposite (NC) hydrogels with controllable gradient structures by adjusting the intensity of the direct current electric field. The results showed that the stiffness, surface property and thermosensitivity of the hydrogel changed with gradient distributions of Laponite. The average stiffness gradients varied from 0.18 kPa/mm, 0.41 kPa/mm to 1.28 kPa/mm by simply adjusting the intensity of the direct current electric field from 0.13 V/mm, 0.20 V/mm to 0.27 V/mm accordingly. The stiffness reached in a range of 13.8–33.0 kPa. The growth behaviors of human cervical cancer cells (HeLa cells) on the gradient NC hydrogel surface were discussed. Spreading and proliferation, as well as morphology of HeLa cells were closely related to the stiffness of the gradient NC hydrogels. This work develops a stiffness-controllable gradient NC hydrogel and opens up a new insight into the better understanding of cells behaviors in different tissues and organs *in vivo*.

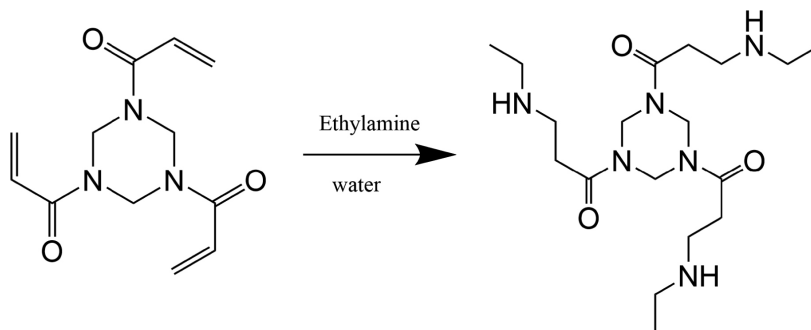


An Acid-/Base-Degradable Epoxy Resin Cured by 1,3,5-Triacryloylamino-hexahydro-s-triazine Derivative

Lei Wang, Shijing Yan*, Lei Zhang*,
Yuliang Mai, Weihao Li,
and Hao Pang

Macromol. Res., **29**, 462 (2021)

1,3,5-Triacryloyl-hexahydro-1,3,5-triazine (TAHT) and ethylamine quickly complete the Aza-Michael addition reaction at the interface of chloroform and water droplets under the catalysis of water. we use the addition product 1,1',1''-(1,3,5-hexahydro-s-triazine-1,3,5-triyl) tris(3-ethylamino-propan-1-one) (TAHT-EA) as curing agent to introduce the 1,3,5-hexahydro-s-triazine (HT) ring structure into the cross-linking network to prepare degradable epoxy resin.

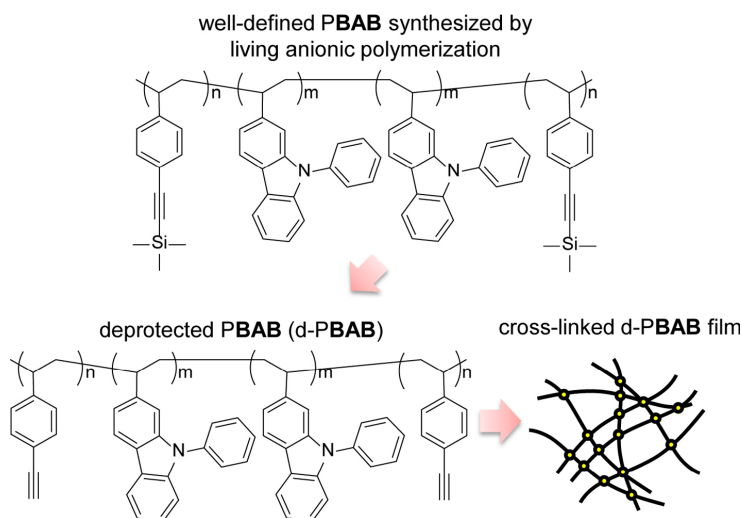


Well-Defined ABA Triblock Copolymers Containing Carbazole and Ethynyl Groups: Living Anionic Polymerization, Postpolymerization Modification, and Thermal Cross-Linking

Beom-Goo Kang*

Macromol. Res., **29**, 470 (2021)

In this study, well-defined block copolymers with hole-transporting carbazole and thermally cross-linkable ethynyl groups are successfully synthesized by living anionic polymerization and a subsequent deprotection reaction without undesirable side reactions, and a block copolymer thin film heated at 250 °C for 60 min shows excellent solvent resistance and increased film density, which make it suitable for solution-processed multilayer device applications.

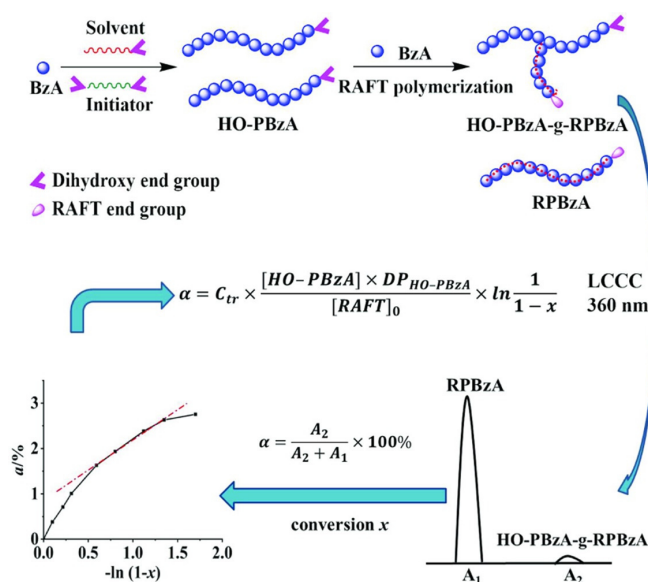


Direct Determination of Interchain Transfer Constants for Radical Polymerization of Benzyl Acrylate by RAFT Polymerization and Polymer Chromatography

Yang Xue, Xiaohua Li, Shixian Zhang, and Ruiwei Guo*

Macromol. Res., **29**, 477 (2021)

In this study, reversible addition-fragmentation chain transfer (RAFT) polymerization of benzyl acrylate (BzA) in the presence of hydroxyl-terminated prepolymer HO-PBzA was carried out with BCBD as a RAFT agent to yield the RAFT polymer RPBzA and the interchain transfer products HO-PBzA-*g*-RPBzA. These two kinds of polymers with UV characteristic absorption at 360 nm were separated and measured *via* polymer chromatography. Thus the degree of interchain transfer and the interchain transfer constants were determined.



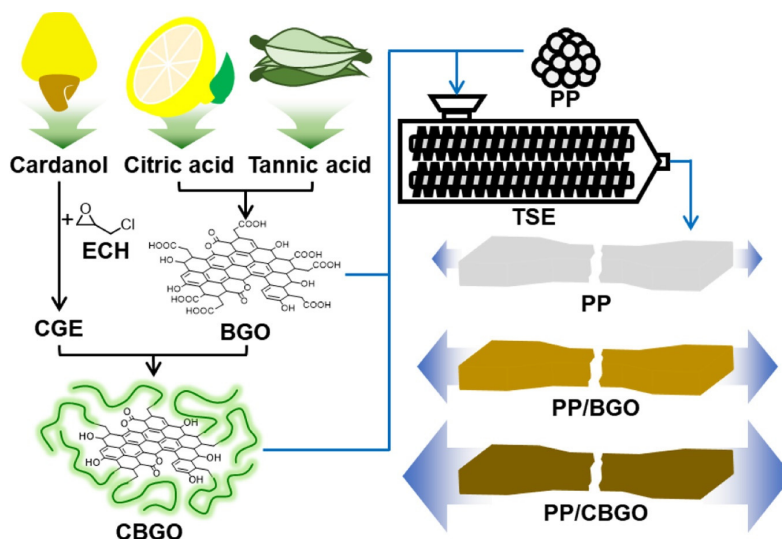
Improving Physical Properties of Polypropylene Nanocomposites by a Natural Resource-Based Bottom-up Graphene Oxide Filler

Huiseob Shin, Min-Young Lim, Saerom Kong, Sangwan Kim, Seung Won Lee, Yonghoon Lee, and Jong-Chan Lee*

Macromol. Res., **29**, 487 (2021)

Cover Paper

Polypropylene (PP) nanocomposites with improved physical properties are prepared using twin screw extruder by the addition of bottom-up graphene oxide (BGO), prepared from citric acid and tannic acid, and cardanol functionalized BGO (CBGO). The mechanical properties of PP nanocomposites are increased by the addition of BGO and CBGO compared to neat PP, and the reinforcing effect of CBGO is greater than that of BGO due to the increased compatibility of CBGO with PP compared to BGO due to the grafted alkyl groups.

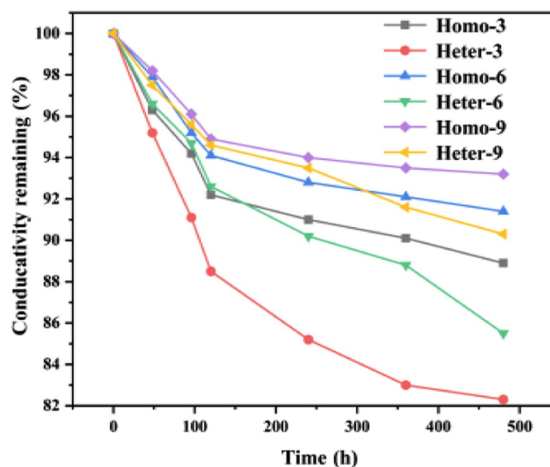


Trimethyl-Ammonium Alkaline Anion Exchange Membranes with the Vinylbenzyl Chloride/Acrylonitrile Main Chain

Zhengan Li, Junjie Chen, JinYue Zhou, YiWen Nie, Chunhui Shen*, and Shanjun Gao

Macromol. Res., **29**, 494 (2021)

A series of anion exchange membranes containing polyolefin main chain and trimethyl-ammonium groups were successfully synthesized. The membranes could obtain considerable conductivity and alkali resistance under the premise of excellent dimensional stability, thermal stability and mechanical strength. Under the condition that water absorption and swelling degree do not affect the normal working performance, the prepared homogeneous benzyl trimethyl-ammonium anion exchange membrane (Homo-6 membrane) has better alkali resistance.



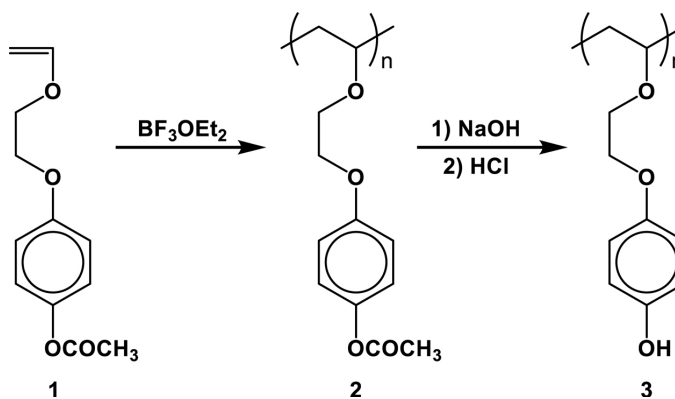
NOTE

Synthesis of Poly(vinyl ether) with Pendant Phenol Groups through Cationic Polymerization of 2-(4-Acetoxyphenoxy)ethyl Vinyl Ether

Takeshi Namikoshi*,
Md. Saifur Rahman,
and Tamotsu Hashimoto*

Macromol. Res., **29**, 505 (2021)

2-[4-(Acetoxy)phenoxy]ethyl vinyl ether **1**, a vinyl ether with a phenolate pendant, was prepared. The cationic polymerization of **1** with BF_3OEt_2 at -78°C produced relatively high-molecular-weight polymers (M_n , up to 112,000) in high yield. The phenolate polymer **2** has oxyethylene spacer between the polymer main chain and the phenolate moiety. The alkaline hydrolysis of the ester pendant of the obtained polymer led to new phenol polymer **3** with poly(vinyl ether)s backbone.

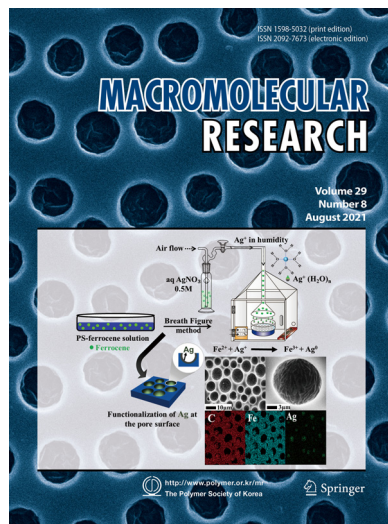


COVER PAPER

Single-Step Pore-Selective Silver-Functionalized Honeycomb-Patterned Porous Polystyrene Film Using a Modified Breath Figure Method

Shahkar Falak, Bo Kyoung Shin, and Do Sung Huh*

Vol. 29, No. 8, pp 519–523 (2021) | AUG 25, 2021 | DOI 10.1007/s13233-021-9070-z



Pore-selective silver (Ag) functionalized honeycomb-patterned (HCP) porous polystyrene (PS) film was fabricated by a modified breath figure (BF) method accompanying an interfacial chemical reaction. It was performed by casting the polymer solution including ferrocene under humid conditions containing AgNO_3 . The film showed HCP porous morphology with pore-selective Ag functionalization. The functionalization of Ag was identified by a scanning electron microscopy with energy-dispersive X-ray spectroscopy and elemental mapping analysis. The conductivity of the film was observed by a four-point probe measuring system and was increased by increasing the ferrocene concentration.

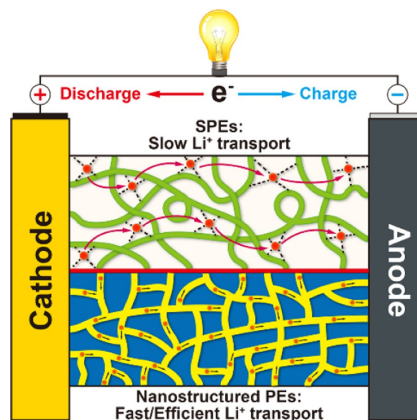
FEATURE ARTICLE

Nanostructured Polymer Electrolytes for Lithium-Ion Batteries

Jeong Hoon Yoon, Won-Jang Cho, Tae hui Kang, Minjae Lee, and Gi-Ra Yi*

Macromol. Res., 29, 509 (2021)

Polymer electrolytes are essential component of next-generation lithium-ion batteries (LIBs). We discussed conventional solid-state polymer electrolytes and their limitation for practical application. Compared previous polymer electrolytes, we suggest nanostructured polymer electrolytes can be improve electrical and mechanical property of polymer electrolytes system for LIBs.



COMMUNICATION

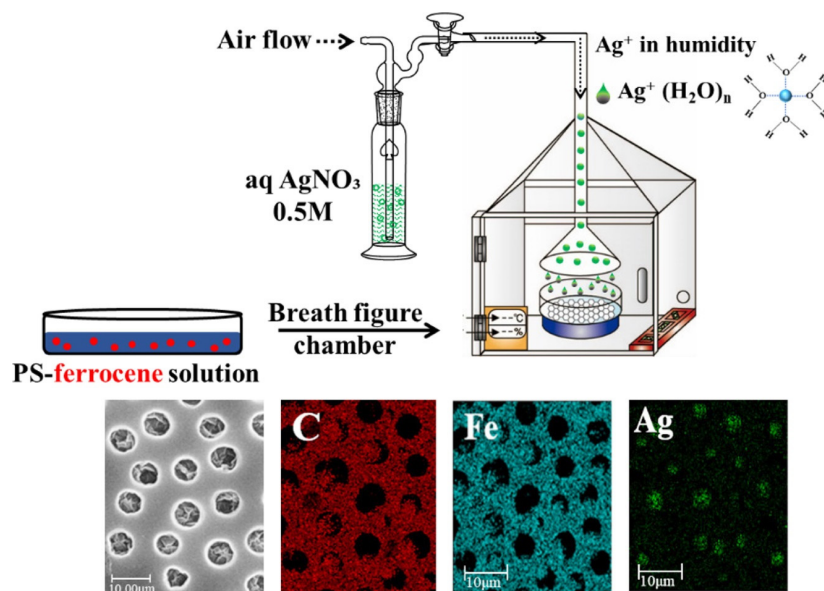
Single-Step Pore-Selective Silver-Functionalized Honeycomb-Patterned Porous Polystyrene Film Using a Modified Breath Figure Method

Shahkar Falak, Bo Kyoung Shin, and Do Sung Huh*

Macromol. Res., **29**, 519 (2021)

Cover Paper

A new fabrication strategy for the pore-selective functionalization of silver (Ag) particles in the honeycomb-patterned (HCP) porous polystyrene (PS) film was demonstrated by a modified breath figure method accompanying an interfacial chemical reaction at the interface of the water droplet and polymer solution. The resulting film showed HCP porous morphology in which Ag was coated selectively in the pores.



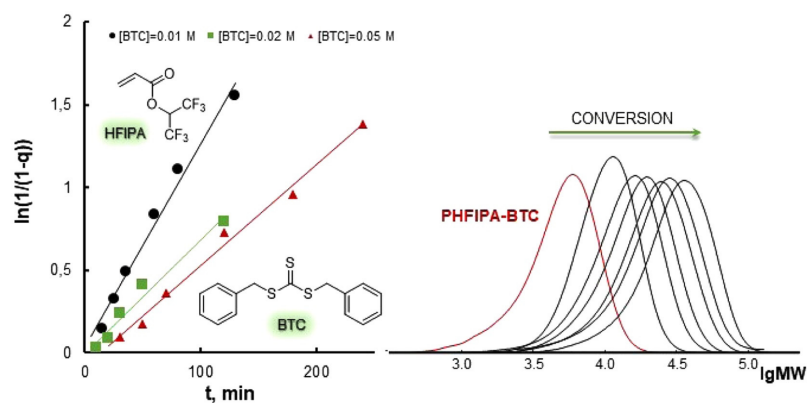
ARTICLES

RAFT (Co)polymerization of 1,1,1,3,3,3-Hexafluoroisopropyl Acrylate as the Synthesis Technique of Amphiphilic Copolymers

Alexandra Grigoreva*, Kseniia Tarankova, and Sergey Zaitsev

Macromol. Res., **29**, 524 (2021)

Reversible addition-fragmentation chain transfer (RAFT) polymerization of 1,1,1,3,3,3-hexafluoroisopropyl acrylate (HFIPA) in the presence of dibenzyl carbonotrithioate (BTC) proceeds in a control mode. Trithiocarbonate group locates asymmetric in polymer chain independently on condition of polymerization process. Copolymerization monomer pairs of HFIPA-acrylic acid and HFIPA-*tert*-butyl acrylate in the presence of low molecular (BTC) and polymeric chain transfer agent was investigated. The use of height-molecular RAFT agent leads to instance of preferential solvation effect.

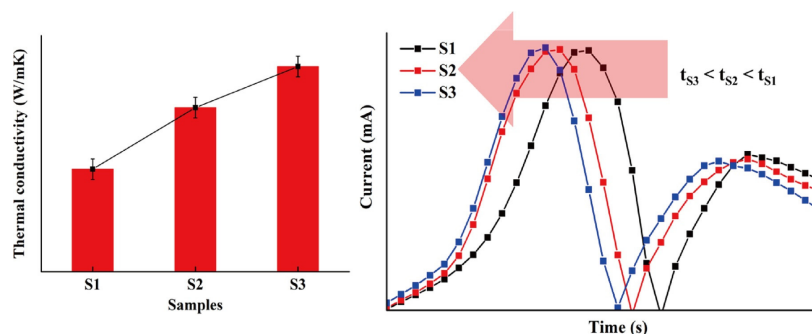


Enhancement of Thermo-Electric Energy Conversion Using Graphene Nano-platelets Embedded Phase Change Material

Chengbin Yu, Jae Ryoun Youn*, and Young Seok Song*

Macromol. Res., **29**, 534 (2021)

Phase change materials (PCMs) containing graphene nano-platelets (GNPs) were fabricated and utilized for efficient thermo-electric energy harvesting during the phase transition process. A system composed of two different PCMs at opposite positions can absorb or release large amounts of thermal energy while remaining in a nearly isothermal condition. Based on the Seebeck effect, the energy harvesting system generates electrical current from temperature differences. The increase in the thermal conductivity of the PCMs can create isothermal fields and enhance thermo-electric energy conversion efficiency. In this study, two different PCM composites were found to exhibit higher thermal conductivity with increasing the amount of GNPs filler. The thermal conductivity of the two composites clearly increased to 0.5858 W/mK and 0.4974 W/mK, while the heating and cooling thermo-electric conversion efficiencies were also enhanced to 55.59% and 33.33%. Furthermore, the thermo-electric energy profiles were numerically modeled using the finite element method (FEM) to compare with the experimental results.

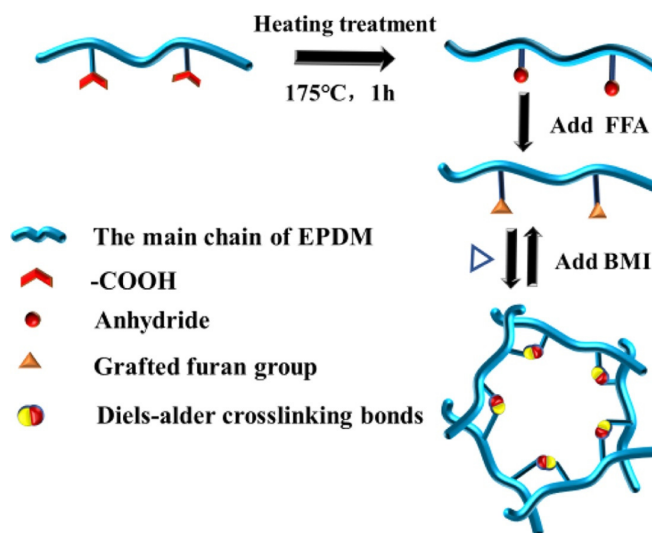


Thermoreversible and Recycling Properties of Ethylene Propylene Diene Rubber Based on Diels-Alder Reaction

Chong Sun, Yehua Jiang, Zhifei Zhang*, Shugao Zhao*, and Laina Guo

Macromol. Res., **29**, 543 (2021)

In this paper, we prepared reversible cross-linking ethylene propylene diene by Diels-Alder reaction between bismaleimide and furan group at 50 °C. The thermoreversible cross-linking ethylene propylene diene rubber exhibited excellent mechanical properties than traditional crosslinking methods, and it showed a better reshaping ability and could be recycled several times. That was much better than the many reported thermally reversible cross-linked ethylene/propylene copolymer rubber.

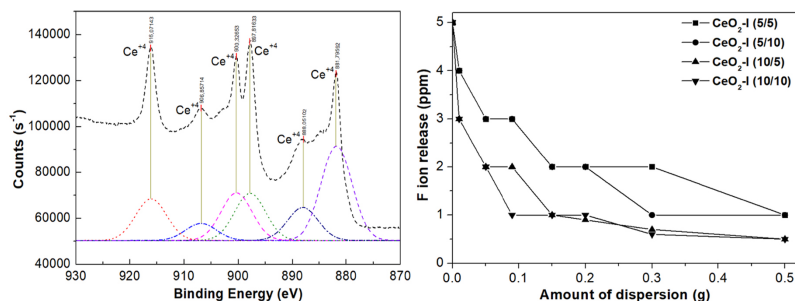


Preparation of Re-Dispersible Metal-Oxide Nanocomposite Particles Using Ionomers with Different EW for Enhanced Radical Scavenging Performance

Mobina Irshad, Chang Hyun Lee, and Juyoung Kim*

Macromol. Res., **29**, 551 (2021)

Metal oxide-ionomer (MO-I) nanocomposite particles were synthesized by using different equivalent weight (EW) ionomers as a dispersing agent to ensure the re-dispersibility and chemical stability of the nanocomposite particles in the ionomer solution. We successfully achieved the nanocomposite particles which avoid the use of any surfactant and high-temperature thermal treatment. A comparison between the radical scavenging performance of nanocomposite particles prepared by our facile method proved CeO_2 -I nanocomposite particles as the best radical scavenger among Al_2O_3 -I and MnO_2 -I nanocomposite particles in the presence of EW800 ionomer solution. CeO_2 -I nanocomposite particles are expected to be appropriate in applications like proton exchange membrane fuel cells, anion exchange membrane fuel cells, and supercapacitors.

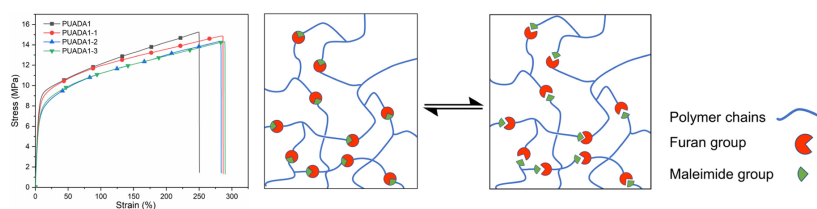


Recyclable and Reprocessable Thermosetting Polyurea with High Performance Based on Diels-Alder Dynamic Covalent Crosslinking

Zhengkai Wei, Yi Wang, Xiaowei Fu, Liang Jiang, Yuechuan Wang, Anqian Yuan, Hualiang Xu, and Jingxin Lei*

Macromol. Res., **29**, 562 (2021)

The novel crosslinked polyurea with excellent recycling and reprocessing properties has been prepared by introducing the Diels-Alder dynamic covalent bond. The prepared polyurea has low relaxation time of ~4 min at 80 °C for facile reprocessing. The tensile strength and elongation at break of crosslinked polyurea could reach 15.24 MPa and 529.2%, respectively, and its mechanical properties remain almost unchanged even after repeated processing.



Synthesis and Characterization of Vinyl-Terminated Poly(dimethyl-co-methylvinyl)siloxane by Ring Opening Polymerization

Yunhee Park, Doo Whan Kang, and Ho-Jong Kang*

Macromol. Res., **29**, 569 (2021)

Octamethylcyclotetrasiloxane and 1,3,5,7-tetramethyl-1,3,5,7-tetravinylcyclotetrasiloxane were ring opening polymerized to prepare vinyl terminated poly(dimethyl-co-methylvinyl) siloxane. Due to the lower reactivity of octamethyl-cyclotetrasiloxane relative to 1,3,5,7-tetramethyl-1,3,5,7-tetravinylcyclotetrasiloxane, at lower copolymerization temperatures the content of dimethyl siloxane block in the copolymer is lower than the feed composition and the product is mainly random copolymers.

